small towns than in large, and leads one to question whether the agricultural labourer is so badly off as he is sometimes represented.

Another interesting application of the method is to the study of the effects of child labour on the development of the child. In Bradford children of the age of twelve are allowed to spend half the day in school and the other half-day earning wages. This is known as the half-time system. Mr. Greenwood shows that the average of the height and weight indices (the combined index number) is low in Bradford for children of twelve years old. Its value is actually 95·7, whereas for children of eleven in Bradford it is 99·2, and for children of twelve in Leeds, Sheffield, and Wakefield, where the half-time system is not in use to so great an extent, it is 97·4, 97·8, and 96·8 respectively. He argues from these figures that the half-day's labour has a deleterious effect on the physique of the child, a result which seems natural enough and is supported by evidence of another kind brought forward in another section of the work. But he makes no mention of the fact that at thirteen years the combined index number goes up again in Bradford to 98·7, which is considerably higher than the corresponding index in Leeds, Sheffield, or Wakefield. In presenting the figures without mentioning this Mr. Greenwood shows a certain bias, at any rate a strong desire to arrive at his conclusion rather than let the statistics lead him where they will. In Oldham the material allowed a direct comparison between the half-time children and those who spend the whole day at school. But the half-timers are throughout larger and heavier than the full-timers. The explanation of this unexpected result is given by the medical officer for Oldham as follows: " (1) That those working half-time are on the average older than those not working; (2) that the tendency would be for the stronger and better developed children to go to work, while the weaker and delicate children would be kept at school; (3) that the worker, as he is bringing in a wage, is better fed than those who are not wage earners." Possibilities which might have an opposite tendency, as for example, that the children of the poorer parents were more likely to be sent to work, are not considered. The question is thus seen to be a complicated one, which will not be solved without the collection and reduction of better data. This should present no particular difficulty, as the exact age of the children in the two groups, their physique, and home conditions might without difficulty be removed from the realms of conjecture and properly allowed for. But though the simple comparison made in the work under review cannot be said to have led to a definite conclusion, it is not for that reason without value as it serves to point the way for future work.

We will conclude by tempering the wind of general commendation which issues naturally from us, by the question, " Why are the diagrams so very sketchy? "

EDGAR SCHUSTER.

Pearl, R. *A Contribution towards an Analysis of the Problem of Inbreeding.* Amer. Nat. XLVII.; 1913; pp. 577-614. *Genetics and Breeding.* Science XXXVII.; 1913; pp. 539-546; and **Parshley,** H. M. *Data on Sex-Determination in Cattle.* Biological Bulletin XXIV.; 1913; pp. 205-225.

IN the first of these papers Dr. Pearl presents a method for determining the intensity of inbreeding. He points out that it is important to start from the individual and work backwards into the ancestry, rather than to start from the ancestry and work downwards. The method adopted consists in finding a coefficient which shall represent the ratio of actual ancestors in any generation to the total possible number of ancestors. For example, if brother is mated with sister for three successive generations, the offspring will have only two great-grandparents instead of the eight which they would have if there were no inbreeding. Three-quarters of the ancestors in that generation have thus been eliminated, and the coefficient of inbreeding for the three generations is therefore 75 per cent.

More generally, if n is the number of generations in the pedigree, p the possible number, and q the actual number of ancestors in nth generation, then Z_n the coefficient of inbreeding for n generations is given by the formula $Z^n = \frac{100\,(p_{n+1}-q_{n+1})}{p_{n+1}}$.

Dr. Pearl points out that in repeated brother-sister mating Z_n soon approaches 100 per cent., so that if no effects are produced in a few generations, any subsequent changes are probably not due to inbreeding as such. Practical methods are given for working out the coefficient in long and complicated pedigrees. The latter part of the paper discusses the relation of inbreeding with continued self-fertilisation, but contains a mistake which vitiates a considerable part of the argument; this mistake is corrected by the author himself in Amer. Nat. XLVIII., p. 57.

The second paper is the presidential address to the Animal Section of the American Breeders' Association, 1913; it points out the importance of the knowledge of the recently discovered principles of heredity in checking the empirical methods commonly used by breeders of animals.

In the third paper the authors have collected records from breeders of 480 births in cattle, in which it was known whether service by the bull took place "early," "in the middle," or "late" in the heat period of the cow. The "early" class contained 248 births, with 125 ♂, 123 ♀; the "middle" class contained 125 births, 67 ♂, 58 ♀; the "late" class contained 107 births, 65 ♂, 42 ♀. The ratio of males to females thus rose from 98·4 ♂, 100 ♀ in the "early" class to 115·5 ♂ 100 ♀ in the "middle," and 154·8 ♂, 100 ♀ in the "late" class. It is concluded that these changes in the sex-ratio cannot be ascribed to any known cause except the difference of time of fertilisation, and that possibly "staleness" of the ovum may tend to destroy the activity of a female-determining chromosome, and allow the ovum to develop into a male. L. DONCASTER.

Laughlin, H. H. *Report of the Committee to Study and to Report on the best practical means of cutting off the Defective Germ Plasm in the American Population.* I. The Scope of the Committee's Work. II. The Legal, Legislative and Administrative Aspects of Sterilization. Eugenics Record Office. Bulletins 10A and 10B. Cold Spring Harbour, Long Island, New York; 1914; Prices 20 cents. and 60 cents; pp. 64 and 150.

BULLETIN No. 10A appears to cover the whole scope of negative eugenics. First the numbers of "Socially inadequate in the American population" are estimated, and then "Cacogenic varieties of the human race," that is to say those who are socially unfit on account of defective inheritance, are classified with great minuteness. The ten main classes to which they are referred are the feeble-minded, paupers, inebriates, criminals, epileptics, insane, the asthenic class, the diathetic class (*i.e.*, those who have a tendency to some specific ailment). The deformed and the cacaesthetic (those suffering from hereditary defects of the sense organs). The remedies which have been proposed "for purging the blood of the race" from the defects enumerated then receive consideration. They are catalogued as follows. 1. Life segregation. 2. Sterilization. 3. Restrictive marriage laws and customs. 4. Eugenical education of the public and of prospective marriage mates. 5. Systems of matings purporting to remove defective traits. 6. General environmental betterment. 7. Polygamy. 8. Euthanasia. 9. Neo-Malthusianism. 10. Laissez-faire. We rather suspect that numbers 7, 8 and 10 were put in owing to the committee's affection for the decimal system. In any case they are dummies easily knocked down. Neo-malthusianism also receives rather scant courtesy, and the efficacy of any "systems of matings purporting to remove defective traits" is questioned. "General environmental betterment" is briefly conceded its place as a necessary part of social reform,